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(54) **SYSTEM AND METHOD FOR CDMA CHANNEL ESTIMATION**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

5,109,390	4/1992	Gilhousen et al.	375/1
5,329,547	7/1994	Ling	375/1
5,568,472	10/1996	Umeda et al.	370/18
5,586,113	12/1996	Adachi et al.	370/342
5,619,524	4/1997	Ling et al.	375/200
5,638,362	6/1997	Dohi et al.	370/342

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0696856	2/1996	(EP) .
0795971	9/1997	(EP) .
0825737	2/1998	(EP) .
WO 9430024	12/1994	(WO) .
WO 9733400	9/1997	(WO) .

OTHER PUBLICATIONS

Article entitled, "Wideband–CDMA Radio Control Techniques for Third–Generation Mobile Communication Systems", by S. Onoe, K. Ohno, K. Yamagata and T. Nakamura, published by 1997 IEEE, pp. 835–839.

Article entitled, Experiments on Coherent Multicode DS–CDMA, by T. Dohi, Y. Okumura, A. Higashi, K. Ohno and F. Adachi, published by IEICE Trans. Commun. vol. E79–B No. 9, Sep. 1996, pp. 1326–1332.

(List continued on next page.)

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(57) **ABSTRACT**

A wideband CDMA receiver system to accept messages from asynchronously transmitting base stations is provided. The base station transmission to each receiver includes a perch channel and at least one traffic channel. Although all the channels typically include pilot symbols for the purpose of demodulating the information symbols of the channel, the pilot channel includes a higher proportion of pilot symbols to information symbols. Therefore, a perch channel based timing and estimation system is inherently more accurate. In addition, the perch channel is generally transmitted at higher power levels than a traffic channel, and the resulting, higher, signal to noise ratio signal also improves the accuracy of the timing and channel estimation. Based on the timing derived from the perch channel of a first base station, the receiver can set the timing of the traffic channel transmissions from a second base station, to more closely match the timing of traffic channel transmissions from the first base station. In this manner, the signal to noise ratio of the demodulated traffic channel information symbols is enhanced through the diversity of using the transmissions of two base stations. A method for receiving wideband CDMA transmissions from asynchronously transmitting base stations is also provided.

28 Claims, 7 Drawing Sheets